

What is claimed is:

1. A pressure-welded semiconductor device comprising:

at least one semiconductor element including a first main surface having disposed thereon at least one element-side electrode and a second main surface being opposite from the first main surface and having disposed thereon at least one element-side electrode;

a casing including a first casing plate and a second casing plate disposed so as to face each other, with a first casing-side electrode being disposed on an opposing surface of the first casing plate and a second casing-side electrode being disposed on an opposing surface of the second casing plate, the at least one semiconductor element being incorporated inside the casing so that the first casing-side electrode and the at least one element-side electrode disposed on the first main surface are pressure-welded and the second casing-side electrode and the at least one element-side electrode disposed on the second main surface are pressure-welded; and

a buffer conductive layer including conductive carbons disposed at at least one of a pressure-welded portion between the first casing-side electrode and the element-side electrode disposed on the first main surface and a pressure-welded portion between the second casing-side electrode and the element-side electrode disposed on the second main surface.

2. The pressure-welded semiconductor device of claim 1, wherein

the conductive carbons are linear carbon structures.

3. The pressure-welded semiconductor device of claim 1, wherein the conductive carbons are carbon nanotubes.

4. The pressure-welded semiconductor device of claim 3, wherein the carbon nanotubes are substantially oriented in a thickness direction of the buffer conductive layer.

5. The pressure-welded semiconductor device of claim 1, wherein the buffer conductive layer is disposed so as to be tightly adhered to at least one of a surface of the at least one element-side electrode disposed on the first main surface forming a pressure-welded portion with the first casing-side electrode and a surface of the at least one element-side electrode disposed on the second main surface forming a pressure-welded portion with the second casing-side electrode.

6. The pressure-welded semiconductor device of claim 1, wherein the buffer conductive layer is disposed so as to be tightly adhered to at least one of a surface of the first casing-side electrode and a surface of the second casing-side electrode.

7. The pressure-welded semiconductor device of claim 1, wherein at least a pressure-welded surface of the at least one element-side electrode disposed on at least one of the first main surface and the second

main surface includes a metal having a catalyst function which enables formation of a carbide.

8. The pressure-welded semiconductor device of claim 7, wherein the metal having the catalyst function which enables formation of a carbide includes at least one selected from Ni, Fe and Co.

9. The pressure-welded semiconductor device of claim 2, wherein both ends of the linear carbon structures are fixed at electrodes.

10. The pressure-welded semiconductor device of claim 2, wherein both ends of the linear carbon structures are carbidized and bonded to electrodes.

11. The pressure-welded semiconductor device of claim 2, wherein gaps between the linear carbon structures are filled with a filler member.

12. The pressure-welded semiconductor device of claim 11, wherein the filler member is at least one selected from the group consisting of metals, ceramics and organic materials.

13. The pressure-welded semiconductor device of claim 11, wherein at least one end of the linear carbon structures is carbidized and bonded to an electrode.

14. A method of manufacturing a pressure-welded semiconductor device comprising the steps of:

preparing at least one semiconductor element including a first main surface having disposed thereon at least one element-side electrode and a second main surface being opposite from the first main surface and having disposed thereon at least one element-side electrode;

forming linear carbon structures on the at least one semiconductor element; and

sandwiching and pressure-welding, with two casing plates having an electrode respectively disposed on surfaces thereof, the at least one semiconductor element having formed thereon the linear carbon structures.

15. The method of manufacturing a pressure-welded semiconductor device of claim 14, wherein the linear carbon structures are formed on the at least one semiconductor element using vapor phase deposition.

16. The method of manufacturing a pressure-welded semiconductor device of claim 14, wherein the linear carbon structures are formed on the at least one semiconductor element using a paste that includes conductive carbons.

17. The method of manufacturing a pressure-welded semiconductor device of claim 14, further including the step of filling

gaps between the linear carbon structures with a filler member.

18. The method of manufacturing a pressure-welded semiconductor device of claim 14, further including the step of carbidizing at least one end of the linear carbon structure and bonding it to an electrode.